Sustainability? Not without New Capabilities in Measurement Science

Brian Landes

The Dow Chemical Company, Core R&D, Analytical Sciences, Midland, MI 48642

The concept of sustainability first emerged in the early 1970's but it exploded onto the global arena in 1987 with the Brundtland Report [1], in which sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The concept can be clearly described on the macro level using objects such as windmills or solar panels, and on the atomic level in describing specific reaction pathways to increase battery efficiencies, or developing model structures that remove impurities from water. The challenges—and thus, the opportunities—lie in the realm in between these two extremes. To design and implement truly sustainable technologies in the arenas of energy capture, energy storage, water filtration, and lightweighting demands the ability to measure the nature and dynamics of complex interactions between atoms, molecules, surfaces, and interfaces that occur in actual end-use environments. This requires the development of new methods to acquire data on "as-used" systems and devices. This talk will describe, by example, the use of these *in situ* experiments in both sustainable energy and materials research. We will also discuss challenges in measurement science that will be necessary to overcome to produce economically viable "sustainable" technologies.

[1] World Commission on Environment and Development (1987). Our Common Future. Oxford: Oxford University Press. ISBN 019282080X.